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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/785,999	02/16/2001	Jay E. Uglow	LAMP1P106A	2171

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EXAMINER

PHAM, THANHHA S

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 07/15/2003

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/785,999

Applicant(s)

UGLOW ET AL.

Examiner

Thanhha Pham

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 April 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-16 and 26 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-16 and 26 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

This Office Action responses to Applicant's Amendment Paper No. 19 dated 4/25/03.

In Applicant's Amendment of Paper No. 19, status of claims 27-31 are withdrawn claimed. Applicant is respectfully reminded that claims 27-31 were cancelled per amendment of Paper no. 10 dated 9/23/02. Therefore, claims 27-31 are now cancelled claims.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. Claims 1-3, 7-10, 14-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Parikh [US 6,225,207] in view of Yu et al [US 6,187,663].

Parikh, figs 4's and col 1-19, discloses a method for making a multi-layer inter-metal dielectric over a substrate thereby forming a dielectric structure for dual-damascene application comprising steps of:

forming a barrier layer (412, fig 4A, col 9 lines 28-33 and col 6 lines 61-66) on a substrate (410) and metallization lines (interconnects, col 6 lines 60-66) within the substrate;

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forming an inorganic dielectric silicon dioxide layer (414, PECVD-SiO₂ or F-SiO₂, fig 4A, col 9 lines 28-42 and col 6 lines 60-67, col 7 lines 1-12 and col 8 lines 66-67 and col 9 lines 1-2) to define a via dielectric layer directly over the barrier layer (412, fig 4C), the inorganic dielectric layer being highly selective relative to the barrier layer when etched;

forming a carbon-doped oxide layer (416, divinyl siloxane benzocyclobutan, fig 4A, col 9 lines 28-42 and col 6 lines 60-67, col 7 lines 1-12 and col 8 lines 66-67 and col 9 lines 4-12) to define a trench dielectric layer directly over the inorganic dielectric silicon dioxide layer;

forming a trench (430, fig 4B, col 9 lines 43-53 and col 7 lines 14-23) through the carbon-doped oxide layer (416) by a first etch chemistry; and

forming a via (440, fig 4C, col 9 lines 55-67) in the trench extending through inorganic dielectric silicon dioxide layer to the barrier layer by a second etch chemistry, the second etch chemistry being different than the first etch chemistry.

Parikh is silent about the inorganic silicon dioxide of PECVD-SiO₂ or F-SiO₂ having a dielectric constant of about 4. However, the claimed range of dielectric constant of about 4 is considered to involve routine optimize routine optimization while has been held to be within the level of ordinary skill in the art. As noted in *In re Aller* 105 USPQ233, 255 (CCPA 1955), the selection of reaction parameters such as temperature and concentration would have been obvious.

"Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some

circumstances, however, changes such as these may be impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art...such ranges are termed "critical ranges and the applicant has the burden of proving such criticality... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."

See also In re Waite 77 USPQ 586 (CCPA 1948); In re Scherl 70 USPQ 204 (CCPA 1946); In re Irmischer 66 USPQ 314 (CCPA 1945); In re Norman 66 USPQ 308 (CCPA 1945); In re Swenson 56 USPQ 372 (CCPA 1942); In re Sola 25 USPQ 433 (CCPA 1935); In re Dreyfus 24 USPQ 52 (CCPA 1934).

In addition, Yu et al (fig 6, col 3 lines 35-39) teaches the inorganic dielectric layer (4) of fluorine doped silicon dioxide (FSG) having the dielectric constant of about 4 (3.5-3.7). Therefore, it would have been obvious for those skilled in the art to use the inorganic dielectric silicon dioxide having the dielectric constant of about 4 as being claimed, per taught by Yu et al to define the via in the dual damascene application. Selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co., Inc. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945) "Reading a list and selecting a known compound to meet known requirements is no more ingenious than selecting the last piece to put in the last opening in a jig - saw puzzle." 65 USPQ at 301.).

2. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Parikh [US 6,225,207] in view of Yu et al [US 6,187,663] as applied to claim 10 above, and further in view of Smith [US 6,277,733].

Parikh in view of Yu et al substantially discloses the claimed method including etching the barrier layer (412, fig 4E -- Parikh reference). Parikh in view of Yu et al does not expressly teach forming a via and trench barrier layer to cover a surface within the via and the trench wherein the via and trench barrier layer is one of tantalum nitride material and tantalum material.

However, Smith teaches forming the via and trench barrier layer (434, fig 2g) of Ta/TaN to cover the surface of the via and the trench of the dual damascene structure (429).

Therefore, it would have been obvious for those skilled in art to modify process of Parikh in view of Yu et al by forming the via and trench barrier layer of tantalum or tantalum nitride as being claimed, per taught by Smith, to make a better device with a better interconnection wherein the peeling and interdiffusion problems are prevented.

3. Claims 1-4 and 7-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al [US 6,255,735] in view of Usami [US 6,077,574] and Yu et al [US 6,187,663].

Wang et al, figs 1-11 and col 1-8, discloses a method for making a multi-layer inter-metal dielectric layer over a substrate thereby forming a dielectric structure for dual-damascene application comprising steps of:

forming a barrier layer (12, silicon nitride, fig 1) on a substrate and metallization lines within the substrate;

forming an inorganic dielectric silicon dioxide layer (14, silicon dioxide or SiO₂, fig 2, col 5 lines 40-41) to define a via dielectric layer directly over the barrier layer, said inorganic dielectric silicon dioxide being highly selective to the barrier layer when etched;

forming an interlayer dielectric film (18, fig 3, col 5 lines 51-67 and col 6 lines 1-11) to define a trench dielectric layer directly over the inorganic dielectric silicon dioxide layer;

forming a trench through the interlayer dielectric film by implementing a first etch chemistry; and

forming a via in the trench extending through the inorganic dielectric silicon dioxide layer by implementing a second etch chemistry which is selective to the barrier layer wherein the second etch chemistry is different than the first etch chemistry.

[see figs 8-9, col 6 lines 35-63].

Wang et al is silent about:

- a)** the inorganic silicon dioxide of SiO₂ having a dielectric constant of about 4; and
- b)** forming said interlayer dielectric film by using a carbon doped oxide layer.

Regarding to **a)**, the claimed range of dielectric constant of about 4 is considered to involve routine optimization while has been held to be within the level

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of ordinary skill in the art. See *In re Aller* 105 USPQ233, 255 (CCPA 1955); *In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmischer* 66 USPQ 314 (CCPA 1945); *In re Norman* 66 USPQ 308 (CCPA 1945); *In re Swenson* 56 USPQ 372 (CCPA 1942); *In re Sola* 25 USPQ 433 (CCPA 1935); *In re Dreyfus* 24 USPQ 52 (CCPA 1934). Moreover, Yu et al (fig 6, col 3 lines 35-39) teaches the inorganic dielectric layer (4) of fluorine doped silicon dioxide (FSG) having the dielectric constant of about 4 (3.5-3.7). Therefore, it would have been obvious for those skilled in the art to use the inorganic dielectric silicon dioxide having the dielectric constant of about 4 as being claimed, per taught by Yu et al to define the via in the dual damascene application. Selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co., Inc. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945) "Reading a list and selecting a known compound to meet known requirements is no more ingenious than selecting the last piece to put in the last opening in a jig - saw puzzle." 65 USPQ at 301.).

Regarding to **b)**, Usami teaches using the carbon-doped oxide layer would provide the interlayer dielectric film with a low dielectric constant of about and no great than 3 and a good resistance to moisture and heat. Therefore, it would have been obvious for those skilled in the art to combine the teaching of Usami to the process of Wang et al to use the carbon-doped oxide layer as being claimed to define the trench dielectric layer to form the trench for interconnection in a device with low RC, good resistance to moisture and resistance to heat. By doing so, a better device with better reliable performance will be formed.

4. Claims 5-7 and 12-13 rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al [US 6,255,735] in view of Usami [US 6,077,574] and Yu et al [US 6,187,663] as applied to claims 4 and 11 above, in further view of Applicant's Admitted Prior Art (APA).

Wang et al in view of Usami and Yu et al substantially discloses the claimed method including forming the inorganic dielectric silicon dioxide layer (14) a via dielectric layer over the barrier layer, said inorganic dielectric silicon dioxide having a dielectric constant about 4 and being highly selective to the barrier layer when etched. Wang et al in view of Usami and Yu et al does not expressly teach forming said inorganic dielectric silicon dioxide layer by using TEOS.

However, it has been known in the art that TEOS can be used for the inorganic silicon dioxide layer. See APA (fig 1 and specification pages 2-3) as an evidence that shows using TEOS for forming inorganic silicon dioxide layer (un-doped TEOS). Therefore, it would have been obvious for those skilled in the art to select TEOS as a known material for forming the inorganic dielectric silicon dioxide in the process of Wang et al in view of Usami and Yu et al to define the via dielectric layer in the dual damascene application. Selection of a known material based on its suitability for its intended use supported a *prima facie* obviousness determination in *Sinclair & Carroll Co., Inc. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945). Reading a list and selecting a known compound to meet known requirements is no more ingenious than selecting the last piece to put in the last opening in a jig - saw puzzle (*Id.* at 301.)

5. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al [US 6,255,735] in view of Usami [US 6,077,574] and Yu et al [US 6,187,663] as applied to claim 10 above, and further in view of Smith [US 6,277,733].

Wang et al in view of Usami and Yu et al substantially discloses the claimed method including etching the barrier layer (12, fig 10, col 6 lines 64-67 and col 7 lines 1-6 – Wang et al reference). Wang et al in view of Usami and Yu et al does not expressly teach forming a via and trench barrier layer to cover a surface within the via and the trench wherein the via and trench barrier layer is one of tantalum nitride material and tantalum material.

However, Smith teaches forming the via and trench barrier layer (434, fig 2g) of Ta/TaN to cover the surface of the via and the trench of the dual damascene structure (429).

Therefore, it would have been obvious for those skilled in art to modify process of Wang et al in view of Usami and Yu et al by forming the via and trench barrier layer of tantalum or tantalum nitride as being claimed, per taught by Smith, to make a better device with a better interconnection wherein the peeling and interdiffusion problems are prevented.

Response to Arguments

6. Applicant's arguments with respect to claims 1-16 and 26 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanhha Pham whose telephone number is (703) 308-6172. The examiner can normally be reached on Monday-Thursday 8:00 AM - 7:00 PM.

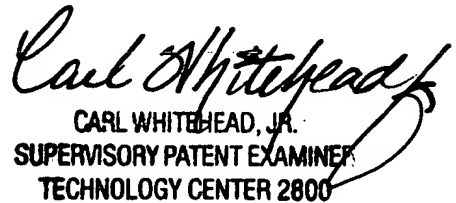
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead Jr., can be reached on (703) 308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are (703)

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308-3432 for regular communications and (703) 308-7725 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Thanhha Pham
July 3, 2003


CARL WHITEHEAD, JR.
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800